

3:35 p. m., three shocks lasting about two seconds, with intervals of two or three seconds; motion apparently horizontal and from SE. to NW.; phenomenon more decided in country east; at San Bernardino courthouse, walls cracked from base to eaves. Campo, 21st, 11.04 p. m., sharp shock. 22nd, 3:22 a. m., sharp shock, followed by a lighter one; motion from SE. to NW., accompanied by a heavy rumbling noise like distant thunder; buildings shook so as to awaken everybody. Tecaluma, San Diego county, 26th, 2:30 p. m., slight shock; 28th, 11 p. m., severe shock. *Oregon*: Portland, 12th, between 8:40 and 8:50 p. m., slight shock in various parts of city. People were startled by the sudden rocking of their dwellings; glass pendants of chandeliers were seen to vibrate violently and several clocks were stopped; no serious damage was reported. *Washington Territory*: Olympia, 7th, 5:54 p. m.—slight shock; motion from SW., lasting a few seconds, another lighter shock reported during the night. 12th, 8:40 p. m., four shocks lasting from 9 to 15 seconds. Port Townsend, 12th, 8:30 p. m.—severe shock, "heavier than one of last week," (7th?) no damage reported. Seattle, 12th, 8:36 p. m.—severe shock, vibrations from SE. to NW. In some instances lamps vibrated four to six inches out of the perpendicular each way. Whatcomb, 27th, 3 a. m.—"Whole summit of Mt. Baker lighted up in grand style and as plain as if seen by sunlight, the fire shooting up far beyond the mountain top in bright flashes, carrying huge red sparks of lava." Bainbridge Island, 7th, 5:45 p. m., N. to S., motion wavy; 10th, 5 a. m., motion perpendicular; 12th, 8:40 p. m., N. to S., motion wavy; 14th, 7 p. m., tremulous; 20th, 11:16 p. m., wavy; 29th, 11:25 p. m., wavy; all shocks distinct but not severe. *British Columbia*: Victoria, 12th, 8:45 p. m., slight shock. *Minnesota*: St. Vincent, 28th, 1:15 a. m., vibrations like earthquake shock.

*Sunsets*.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service Stations. Reports from 169 stations show 5,198 observations to have been made, of which 35 were reported doubtful; of the remainder, 4,113 or 79.2 per cent. were followed by the expected weather.

*Sun Spots*.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C.:

DATE— Dec., 1880.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots.	
1st, 4 p. m...	0	0	0	0	0	0	2	15	
2nd, 8 a. m...	1	3	0	0	1	3	3	15	
3rd, 8 a. m...	1	5	0	0	1	5	3	10	Faculae.
4th, 8 a. m...	2	4	0	0	0	0	5	14	Faculae.
1 p. m...	2	3	0	0	0	0	7	25†	Faculae. Many of the spots small.
2 p. m...	0	0	0	0	0	0	7	25†	
7th, 9 a. m...	0	5	3	5	0	0	4	25	Faculae.
9th, 9 a. m...	0	0	1	5	0	0	3	15	Faculae.
10th, 9 a. m...	0	0	0	0	0	0	3	15	Faculae.
11th, 1 p. m...	0	0	0	0	0	0	2	10	
12th, 1 p. m...	0	0	0	0	0	0	2	10	
15th, 9 a. m...	0	0	2	10	0	0	0	0	Faculae. Spots probably disappeared by solar rotation.
17th, 1 p. m...	2	9	1	0	2	9	2	9	
17th, 1 p. m...	0	3	0	0	0	3	2	12	Faculae.
18th, 4 p. m...	0	0	0	0	0	0	2	12	Faculae.
19th, 9 a. m...	0	0	0	0	0	0	2	12	Faculae.
22nd, 9 a. m...	1	1	0	0	1	1	3	4	Faculae.
23rd, 9 a. m...	0	10	0	0	0	0	3	14	Faculae.
23rd, 9 a. m...	2	5	0	0	2	5	3	8	Faculae. Spots probably re-appeared by solar rotation.
27th, 4 p. m...	0	0	0	0	0	0	3	6	Faculae.
30th, 9 a. m...	0	0	0	0	0	0	3	6	Faculae.
31st, 8 a. m...	1	4	0	0	0	0	4	10	Faculae.

† Approximated.

## NOTES AND EXTRACTS.

The following is extracted from a memoir by M. Dechevrens, S. J., on a "magnetic storm at Zi-ka-wei, near Shanghai, China, in August, 1880:"

*Magnetic Perturbation of August 11th–14th, 18th and 19th, 1880.*—"The perturbation of the 11th–14th, 1880, is the most important registered at Zi-ka-wei," \* \* \* "The intensity of these perturbations in this locality, which is quite a southerly one, will be apparent, less from the absolute size of the abnormal oscillations of our magnetic needles, than from the really striking contrast of the curves, so marked and changeable, with the perfectly regular curves almost daily obtained. Indeed, the mean curves for the year 1879, which we have thought proper to place side by side with the photographic traces during the long period of disturbance might as well have been replaced by a monthly or even by a daily curve taken at random.

"The third of our variation-compasses, the *balance-magnet*, (vertical component of terrestrial magnetic intensity,) experienced, notwithstanding its slowness of motion, quite marked variations at the times of the greatest disturbance. Suffice it to say that the greatest oscillations of the balance-magnet have been simultaneous with the oscillations of the two others, that they have been in a direction contrary to those of the biflar, showing indeed a great increase of the vertical component of intensity, whilst the horizontal component experienced a corresponding diminution: so that the general effect of the perturbation was to increase the vertical component and diminish the horizontal. On the other hand the magnetic declination, which in this place is 2° W., constantly varied inversely to the horizontal component, but with comparatively less amplitude.

"We have, then, three certain facts:—the two components of magnetic intensity have simultaneously experienced variations in contrary directions; the general effect of the perturbation has not caused any notable change in the intensity of the magnetic force of the globe, but rather in the inclination of the line of greatest force;\* finally the variations of the declination are always found in opposition to those of the horizontal component of intensity, but less marked than the latter.

"It seems that these three facts can be connected and the disturbance attributed to a cause.

"In the *magnetograph* the needle of declination is naturally in the magnetic meridian, its north pole pointing to the north, but  $2^{\circ}$  to the west of the astronomic meridian; the needle of the bifilar by the torsion of the two supporting threads, has been brought into the plane perpendicular to the magnetic meridian, its north pole pointing to the west; as to the balance-magnet, it oscillates vertically in the magnetic meridian, naturally, when in horizontal equilibrium, its north pole points to the north. It follows from this arrangement, if we consider only the north poles of the magnets, that every movement of the first towards the west is caused by an increase of declination, that every movement of the second toward the south, shows a decrease of the horizontal component of magnetic intensity, while every downward movement of the third coincides with an increase of the vertical component. The first two have, therefore, constantly moved in unison or in the same direction, either from right to left or from left to right, in the first case the balance-magnet inclines its north pole, in the second it raises it and the first of these two kinds of movements especially prevailed during the perturbation of the 11th to the 14th, and that of the 18th.

"These accordant movements are very simple and do not differ from those which would be produced by a powerful magnet placed at a certain distance to the northeast or north-northeast and above the plane of the magnetograph, the north pole pointing south. Thus placed this magnet would exercise a repulsive action upon the north poles of the magnets of the apparatus, causing the magnet of declination to deviate to the west, that of the bifilar from the west to the south, and repelling downward that of the balance-magnet; moreover, we see that the action of this disturbing magnet would be quite feeble upon the unifilar, that its influence would be great upon the balance-magnet and controlling upon the bifilar, since this magnet presents itself by its two poles almost normally to the disturbing action, whilst the magnet of declination presents to it only its north pole and parallel almost in the same plane.

"This disturbing force, by changing its plane horizontally either to the right or to the left, or else by varying rapidly itself in intensity, could give rise to the very many oscillations registered by the photographic apparatus. The plate shows the similitude between the two curves of declination and the horizontal component.

"Now what could have been this disturbing force?

"Although no particular sign gave evidence of it upon our horizon, we believe that an aurora borealis of unusual intensity prevailed, especially at the time of the first perturbation; the geographical position of the earth's magnetic pole, whether to the north of America, according to the common opinion, or in Behring's Strait, as was maintained by some a few years ago, would carry far to the northeast of China the location of the disturbing force of our magnets. No one to-day is unaware that auroræ boreales or australes are almost invariably accompanied by perturbations in the elements of terrestrial magnetism, that frequently the magnetic perturbation is general over the globe, and that when such is the case an aurora australis occurs simultaneously with an aurora borealis.

"We should be exceedingly happy and thankful to receive any reliable information as to the facts in the case.

"During these two perturbations, August 11th–14th and 18th–19th, we were not able, notwithstanding the most earnest attention and the best will in the world, to discover upon the various curves of our registering barograph, thermograph or anemograph, the slightest abnormal variation which might be brought in parallel with the corresponding magnetic curves and which might, therefore, warrant us in finding any bond or connexion whatever between this important magnetic phenomenon and the concomitant meteorological phenomena. Some are inclined to attribute either to auroræ boreales or to magnetic perturbations an influence in the formation of cyclonic movements in the atmosphere or inversely. Be that as it may, the magnetic perturbation observed here in the extreme East, and which was important and general, as we shall see, left the seas of China entirely calm.

"The extent of the perturbation of the 11th–14th of August, must have been considerable, if we may judge by the following memoranda, for which we are indebted to the kindness of Mr. Helland, superintendent of telegraph lines at Shanghai. Shanghai is connected telegraphically with Europe by two cables, one entirely submarine to London via Hong Kong; the other submarine via Nagasaki (Japan) to Vladivostok, (Siberia) and aerial from Vladivostok to St. Petersburg; moreover, telegraph lines have been established throughout Japan, from Nagasaki to Hokodadi (Island of Jesso.) Now, all these lines, without exception, were affected during the magnetic perturbation recorded at Zi-ka-wei, by strong foreign electric currents. We translate the memoranda communicated to us.

"August 11th, 7:45 p. m. to 7:55 p. m., (Shanghai mean time) communication between Nagasaki

\* On the 12th, from 8:40 to 10:20 p. m., according to the variations of the two components of intensity, the inclination would have increased  $17' 20''$ , the normal daily variation rarely exceeds  $2'$ . During the same time the magnetic declination varied at the most, only  $15'$ .

and Shanghai interrupted; at the two stations the galvanometer shows a very strong current deflecting the needle from  $10^{\circ}$  to  $15^{\circ}$  and setting in operation the electric bells. The direction of the currents was not noted."

"August 12th, 7:42 p. m., the same phenomena observed at Nagasaki and Shanghai."

"From 8:40 to 9:25 p. m., communication between Vladivostok and Nagasaki interrupted by foreign currents circulating in the cable: they are negative at Vladivostok. Positive current at Nagasaki from 8:40 to 8:55 p. m., then negative current, disappearing at 9:46 p. m."

"8:25 p. m., trouble in the cable from Nagasaki to Shanghai; negative currents in Japan, positive at Shanghai; maximum intensity at 9:16 p. m."

"From 8:25 to 9 p. m., strong currents in the Shanghai—Hongkong cable, positive to the north, negative to the south. The same phenomenon observed at Gutzlaff, (near Yang-tse-kiang): positive currents were observed in the two cables of Nagasaki and Hongkong. The Hongkong cable became free at 9:30 p. m., but the trouble continued in the Nagasaki cable up to 10 p. m., the time the office closed."

"Strong foreign currents were also observed on the aerial lines of the Japanese empire, from 8:30 to 6:30 p. m., of the 12th, reaching northward as far as Jesso."

To the preceding indications we add a short memorandum of magnetic observations, received from the executive officer on board the American steamer "Ticonderoga," the vessel being at anchor in the port of Nagasaki.

"August 11th, at 7 p. m., (Nagasaki time—6:25 p. m., Shanghai time.) I observed a peculiar damping of my needles in amplitude to the north, and a slight vertical oscillation of the suspended needle."

The above communication of the Superintendent of telegraphs ends with these words: "The following days nothing extraordinary was noticed on the lines." Having been written on the 4th of September, this last information would lead us to suppose that the short magnetic perturbation of August 18th was of slight importance.

"We have reason to hope that, thanks to the enlightened zeal and kindness of the Superintendent of telegraphs at Shanghai, we shall have in the near future abundant facts to compare and discuss."

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Chief Signal Officer.

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